
**SILVER BOW CREEK/BUTTE AREA NPL SITE
BUTTE PRIORITY SOILS OPERABLE UNIT**

Draft Final

*Granite Mountain Memorial Area (GMMA) Phase II
Remedial Action Work Plan/Final Design Report
(RAWP/FDR)*

Atlantic Richfield Company

October 10, 2008

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Prepared for:

Atlantic Richfield Company
317 Anaconda Road
Butte, Montana 59701

Prepared by:

Pioneer Technical Services, Inc.
P. O. Box 3445
Butte, Montana 59702

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1.0 INTRODUCTION

This Remedial Action Work Plan/Final Design Report (RAWP/FDR) presents the Remedial Design (RD), Construction Drawings (Appendix A), and Technical Specifications (Appendix B) for the Granite Mountain Memorial Area (GMMA) located within the Butte Priority Soils Operable Unit (BPSOU) of the Silver Bow Creek/Butte Area National Priorities List (NPL) Site. The GMMA RAWP/FDR has been broken into two phases. This document (GMMA Phase II RAWP/FDR) outlines the upgrades for the Granite Mountain Memorial; and the RDs for the storm water controls for the Granite Mountain Mine; Mine Waste Repository, Pilot of Butte drainages; reclamation at the Mountain Con and Foreman's Park areas; the remaining trail system from the existing Mineyard & Butte Hill Trail to the north side of Mountain Con Mine Yard; the maintenance roads and trail systems within the restricted historical mine district; and the development and installation of Institutional Controls (ICs). The area addressed under this GMMA Phase II RAWP/FDR is provided on Sheet 3 of the Construction Drawings (Appendix A).

1.1 Granite Mountain Memorial Area Description

The BPSOU site is centered on the 'Butte Hill' and covers approximately five square miles. The BPSOU is located west of the Continental Divide and encompasses the northwestern portion of the Summit Valley.

The GMMA was an addition to the BPSOU and is located in the northeastern part of the OU. The GMMA consists of approximately 350 acres that have been dedicated to the 168 miners who perished in the Granite Mountain-Speculator fire in 1917.

As outlined in the *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) and *Record of Decision* (ROD) (EPA, 2006) portions of the GMMA would be reclaimed and portions would be reserved as a Historic Mining District. The conceptual model identified the Mountain Con Mine Yard/Foreman's Park area as a seasonal access area. After review of the potential trail alignments and at the request of Butte-Silver Bow County, the Mountain Con Mine Yard/Foreman's Park area has been considered a full-time access area for this GMMA Phase II RAWP/FDR. The GMMA reclamation design was based on access and the potential future development by Butte-Silver Bow County. However, not all of the areas designated as full-time public access will be reclaimed under this GMMA Phase II RAWP/FDR but in the future by others. Given the aforementioned, the boundary of the restricted area has been modified and located east of the Mountain Con Mine Yard/Foreman's Park areas. Portions of the GMMA designated as restricted access would not require reclamation and will be preserved as historical mining landscape. The portions identified as full-time public access, seasonal access and restricted access are provided on Sheet 3 of the Construction Drawings (Appendix A).

1.2 Site Setting

1.2.1 Climate

The Butte area climate is characterized by short, cool, dry summers and long cold winters. The annual precipitation in Butte generally varies from 6 to 20 inches per year, with an average of 13 inches. The greatest amount of precipitation, approximately one third, occurs during the months of May and June. The estimated annual evaporation in the Butte area is 30 inches (NOAA, 2002), therefore exceeding the annual precipitation.

1.2.2 Topography

The GMMA is located in the northeastern portion of the BPSOU at elevations ranging from 5,915 to 6,315 feet above mean sea level (amsl). The topography is irregular due the presences of large waste rock dumps. The general slope of the terrain is to the south/southeast toward the Berkeley Pit and Kelley Mine Yard. The southeast boundary of the GMMA is located along the Berkeley Pit high wall.

1.2.3 Geology

Granitic rocks of the Boulder Batholith underlie the GMMA. They are primarily quartz monzonite intersected by porphyritic dikes and plugs. The rocks are fractured and faulted and extensively mineralized. This mineralization was a target for the local mining. The presence of bedrock outcroppings would indicate that the depth-to-bedrock is very shallow.

1.2.4 Hydrology

There are no significant hydrologic features located in the GMMA.

1.2.5 Storm Water Hydrology

Storm water improvements completed at the Kelley Mine Yard and elsewhere under the BPSOU Storm Water Time Critical Removal Action (TCRA) (UAO Docket No. 95-58) route storm water runoff from portions of the Butte Hill to the Berkeley Pit through a system of channels and sedimentation basins. Storm water within the GMMA currently flows to the Berkeley Pit through underground shafts or overland flow. Consistent with this strategy, additional storm water features constructed in the GMMA will drain toward the Berkeley Pit. There are six drainages that will be addressed in the reclamation efforts at the GMMA. They are as follows: Bell Diamond, Granite Mountain Mine, Mine Waste Repository, Moose and Green Mountain Shaft, Mountain Con and Kelley, and the Pilot of Butte. The drainages to be addressed under this GMMA Phase II RAWP/FDR will be the Granite Mountain Mine, Mine Waste Repository, Mountain Con, and the Pilot of Butte. The Bell Diamond, Moose and Green Mountain Shaft, and Kelley storm water controls were addressed in the *Final Granite Mountain Memorial Area (GMMA) Phase I Remedial Action Work Plan/Final Design Report (RAWP/FDR)* (Atlantic Richfield Company, 2008).

1.3 Previous Investigations and Actions

Numerous previous investigations and actions have been conducted within the BPSOU. Investigations of the area started in the 1960s and increased in 1983 when the site became an NPL Site. A summary of the investigations are provided in Section 2.0 of the ROD (EPA, 2006).

A summary of the sampling results was outlined in Section 5.2.2.2, "Granite Mountain Memorial Area" of the ROD (EPA, 2006). Section 5.2.2.2 states the following: *"Surface soils and mine waste materials in this area have been sampled and analyzed during three separate sampling programs. Of the 65 samples collected, only one exceeded the open space/recreational action level for arsenic. Seven (11 percent) exceeded the source area action level for lead. Air monitoring was conducted at the GMMA for a one-year period. The results indicated there were no elevated or exceedances of heavy metals during the air sampling."*

1.3.1 GMMA Air Monitoring

The purpose of the GMMA air monitoring was to provide data that would help determine human health risks, if any, due to the inhalation of particulate matter by visitors and workers at the GMMA. The U.S. Environmental Protection Agency (EPA) approved the *Silver Bow Creek/Butte Area NPL Site Butte Priority Soils Operable Unit Granite Mountain Area (GMA) Air Monitoring and Sampling and Analysis Plan (SAP)* (BPSOU PRP Group, 2003) to conduct the air monitoring in early 2004. Air monitoring under the SAP was initiated on May 6, 2004 and ended on December 31, 2004. During the eight months of air monitoring, there were no exceedances of the ambient air quality standards. On March 30, 2005, the EPA sent a letter to the PRP Group stating, *"Based on the eight months of analytical data indicating that there have been no exceedances of the ambient air quality standards, EPA will require no further air sampling of this area"*.

2.0 REMEDIAL ACTION OBJECTIVES

The remedial action objectives (RAOs) for solid media (contaminated soils, indoor dust, waste rock, and tailings) were outlined by the EPA in Section 8 of the BPSOU ROD (EPA, 2006). The RAOs as outlined in Section 8 of the BPSOU ROD have been reiterated below.

"The RAOs for contaminated solid media in the OU are to:

- Prevent the ingestion of, direct contact with, and the inhalation of, contaminated soils, indoor dust, waste rock, and / or tailings or other process waste that would result in an unacceptable risk to human health assuming current or reasonably anticipated future land uses.*
- Prevent releases of contaminated solid media to the extent that they will not result in an unacceptable risk to aquatic environmental receptors.*

- *Prevent releases of contaminated water from solids media that would result in exceedances of the Montana State Water Quality Standards for surface water.*
- *Prevent releases of contaminated water from solid media that would result in exceedances of the Montana State Water Quality Standards for groundwater, except where ARAR waivers are appropriate and other means to protect from associated risks are available.*
- *Remediate contaminated solid media to the extent that it will not result in an unacceptable risk to human health and/or aquatic environmental receptors.*
- *Prevent release of contaminated water from solid media that would result in degradation of surface water, in accordance with the surface water RGs."*

3.0 REMEDIAL ACTION LEVELS

The primary Constituents of Concern (COCs) in the BPSOU are arsenic and lead. The remedial action (RA) levels as outlined in the BPSOU ROD (EPA, 2006) for arsenic and lead are as follows:

BPSOU ROD Action Levels

Constituents of Concern	Exposure Scenario	Concentration
Lead	Residential	1,200 mg/kg
	Non-Residential	2,300 mg/kg
Arsenic	Residential	250 mg/kg
	Commercial	500 mg/kg
	Recreational	1,000 mg/kg

mg/kg – milligrams per kilogram

4.0 GRANITE MOUNTAIN MEMORIAL PHASE II DESIGN

This section describes the design, design criteria, design assumptions for the following GMMA Phase II RAWP/FDR design components:

1. GMMA Phase II (Mountain Con Mine Yard and area to south) Grading Designs (Section 4.1);
2. GMMA Trail Designs (Section 4.2);
3. East Pacific Street Extension Design (Section 4.3);
4. GMMA Parking Lot Designs (Section 4.4);
5. Mountain Con Water Line Design (Section 4.5);
6. Mountain Con Sewer Line Design (Section 4.6);
7. GMMA Maintenance Road Design (Section 4.7);
8. GMMA Phase II Storm Water Control Designs (Granite Mountain Mine, Mine Waste Repository, and Pilot Butte) (Section 4.8);

9. GMMA Phase II Reclamation Design (Section 4.9);
10. Foreman's Park Design (Section 4.10);
11. Mountain Con/Foreman's Park Amenities (Section 4.11);
12. Granite Mountain Memorial Upgrades/Modifications (Section 4.12);
13. ICs (Section 4.13);
14. Existing Historical Feature Preservation and Signage (Section 4.14); and
15. Helehan Borrow Development (Section 4.15).

4.1 GMMA Phase II Grading Design

The GMMA Phase II grading designs consists of grading the Mountain Con Mine Yard and areas located to the south of the mine yard. Steep slopes consisting of mine waste materials will be graded to slopes of 3:1 (H:V) or less. The east side of the Mountain Con Mine Yard will be graded to slopes less than 3:1 (H:V) for potential future recreational opportunities. In addition to grading the steep slopes, the grading design incorporates the installation of the GMMA Trail, storm water controls, parking lots, etc. Details regarding these designs will be discussed in their respective sections in this report. The grading design initially took a mass balance approach, but given the topography and design constraints it will be necessary to haul materials to accomplish the final grade design. Based on a mass balance (cut 40,250 cubic yards/fill 44,000 cubic yards) it is estimated that approximately 3,750 cubic yards of additional materials will need to be hauled into the site. Based on the completed grading design, it is estimated that 5,000 to 10,000 cubic yards of materials will need to be hauled to the Mountain Con Borrow Area and used as fill materials for the area south of the Mountain Con headframe. The additional fill materials required to meet the grading design will be hauled from the Mountain Con Borrow Area (Sheets 60 to 62 of the Construction Drawings provided in Appendix A). These materials are easily accessible by the maintenance road. Clean structural fill will be imported to the site for those areas identified on the Construction Drawings (Appendix A) or as otherwise specified in the Technical Specifications provided in Appendix B.

Large volumes of wood debris and metal are located on the slopes located north and south of the Mountain Con headframe. All wood debris and metal will be removed from the slopes prior to grading to prevent future settling of the final cap. The wood cribbing that is intact on the slope south of the Mountain Con headframe will remain intact for stability while grading. All other wood debris and metal will be transported to the Mine Waste Repository for disposal. The maintenance road discussed in Section 4.7 will be utilized to haul wood debris and wastes to the Mine Waste Repository (Sheet 9 of Construction Drawings provided in Appendix A).

Several sink holes have been identified (Sheet 9 of Construction Drawings provided in Appendix A) and require that they be filled. Prior to grading, the sinkholes will be exposed, backfilled, and compacted with the available fill materials.

The design also incorporates one location at the base of the slope located south of the Mountain Con headframe where future tree pods can be planted by Butte-Silver Bow County to soften the reclamation view. Upon completion of the grading, the footprint will be reclaimed utilizing the reclamation design discussed in Section 4.9.

4.2 GMMA Phase II Trail Designs

The GMMA Phase II trail designs consists of six individual trails which consist of the following: the GMMA Phase II trail from the Mineyard & Butte Hill Trail to the Center Street parking lot located north of the Mountain Con; Foreman's Park Trail; Mountain Con Hoist House trail; Buffalo Street trail; Belle Diamond walking trail; and the Pilot of Butte Mine walking trail. The GMMA Phase II trail; Foreman's Park Trail; Mountain Con Hoist House trail; Buffalo Street trail are located within the full access area and have been designed for Americans with Disabilities Act (ADA) use. The Belle Diamond and the Pilot of Butte Mine walking trails are located within the restricted area and will be utilized only for guided tours. The Belle Diamond and the Pilot of Butte Mine walking trails were not designed to ADA guidelines. The following sections discuss the design of each of the six trail systems.

4.2.1 GMMA Phase II Trail System

The *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) and ROD (EPA, 2006) indicated that a trail system would be constructed linking the Mineyard & Butte Hill Trail to the Granite Mountain Memorial. The conceptual trail system was to run west and north of the Mountain Con/Foreman Park area to a parking lot located north of the Foreman's Park area and from there to the Granite Mountain Memorial. The *Final Granite Mountain Memorial Area (GMMA) Phase I Remedial Action Work Plan/Final Design Report (RAWP/FDR)* (Atlantic Richfield Company, 2008) addressed the GMMA Trail from the Center Street parking lot north of the Mountain Con/Foreman's Park area to the Granite Mountain Memorial. The remainder of the GMMA Trail from the Center Street parking lot located north of the Mountain Con/Foreman's Park area linking it to the end of the Mineyard & Butte Hill Trail at the Kelley Rail Yard will be designed under this Phase II GMMA RAWP/FDR.

The conceptual GMMA Trail system outlined in the *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) and ROD (EPA, 2006) indicated that the portion of the trail that linked the Center Street parking lot north of the Mountain Con/Foreman's Park area to the end of the Mineyard & Butte Hill Trail at the Kelley Rail Yard would run parallel to Wyoming Street up to Buffalo Street and from Buffalo Street the trail would run along the west side of the Mountain Con Mine Yard to the parking lot located on the northwest side of the Mountain Con Mine Yard. Review of the conceptual trail alignment indicated that the trail grade would be very steep and the given topography and available space would not accommodate the construction of switchbacks. Therefore, after further review of potential trail alignments and the changing of the access designation for the Mountain Con Mine Yard from seasonal public access to full-time public access, a trail alignment with grades of 15 percent or less was identified and utilized for the design of the trail system in this GMMA Phase II RAWP/FDR (Sheet 3 of the Construction Drawings in Appendix A).

The GMMA Trail was designed as a multi-use trail system for pedestrians and bicycles. The GMMA was designed at 10 feet wide and to ADA guidelines for pedestrian trails. The grades were kept at 12 percent or less and incorporated the placement of rest areas. Given the topography and physical limitations, there are 2 locations where slopes exceed 12 percent but the

areas are accessible from alternate access points. The placement of rest areas was based on ADA guidelines. The rest areas were placed at the beginning and end of each grade change and spaced according to the following.

ADA Guidelines

Trail Grade (%)	Trail Classification	Rest Area Spacing (feet)
0 to 5	Easy	600
5 to 8	Moderate	400
8 to 12	Difficult	200

In addition to the ADA guidelines, rest areas were located based on constructability, safety, and view. Each of the rest areas will be equipped with a bench, and rest areas near roads will be equipped with a bench and trash receptacle.

Typical cross-sections of the GMMA Phase II Trail can be found on Sheets D3 and D4 of the Construction Drawings provided in Appendix A. A plan and profile view of the GMMA Phase II Trail is provided on Sheets 16 to 18 of the Construction Drawings (Appendix A).

The American Association of State Highway and Transportation Officials (AASHTO) "*Guide for the Development of Bicycles Facilities*" was utilized to design the GMMA Trail for bicycle use. The AASHTO standards recommend a design speed of 30 miles per hour (mph) for grades greater than 4 percent and a horizontal curve radius of 225 to 260 feet. Given the topography in the area of the GMMA Trail, a curve radius of this nature was not achievable. It will be necessary to post speed limit signs and caution signs for bicycles. Trail signage has been developed and outlined on Sheet 22 of the Construction Drawings provided in Appendix A. In addition, the GMMA Trail was designed with trail separation along the Mountain Con Mine Yard parking lot. The designed GMMA Phase II Trail is outlined on Sheets 16 to 18 of the Construction Drawings provided in Appendix A.

4.2.2 Foreman's Park Trail System

The *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) and ROD (EPA, 2006) indicated that the roads within the Foreman's Park area would be preserved for use within the park area. During the design process it was determined that a trail system would be constructed around the outer perimeter of the Foreman's Park area. This trail system was designed utilizing the existing roadways and the design criteria outlined in Section 4.2.1. However, the trail will be restricted to pedestrians use only, bicycle use will be restricted. To restrict the use of the trail by bicyclists, a pedestrian gate will be installed at Station 9 +00 of the Foreman's Park Trail and a no bicycle sign will be posted at the pedestrian gate. This was done to avoid mixing potential fast bicycle traffic with pedestrian use in the area. This action was taken due to the poor line of sight along the Foreman's Park trail between Stations 5+00 and 9+00. The design for the Foreman's Park trail consisted of minor grade changes and the replacement of the existing asphalt. All historical retaining walls will be preserved. The

Foreman's Park Trail design is outlined on Sheet 19 of the Construction Drawings provided in Appendix A.

4.2.3 Mountain Con Hoist House Trail System

The Mountain Con Hoist House Trail system was designed as an extension of the GMMA Phase II Trail to provide public access to the Mountain Con Hoist House. The trail was designed utilizing the ADA guidelines discussed in Section 4.2.1. The Mountain Con Hoist House trail was designed with easy grades, rest areas and will consist of an asphalt surface. The Mountain Con Hoist House Trail design is outlined on Sheet 20 of the Construction Drawings provided in Appendix A.

4.2.4 Buffalo Street Trail System

The Buffalo Street Trail system was designed as an extension of the GMMA Phase II Trail to provide the public access to the Buffalo Street Parking Lot. The trail was designed utilizing the ADA guidelines discussed in Section 4.2.1. The Buffalo Street trail was designed with easy grades, rest areas, and will consist of an asphalt surface. A pedestrian gate will be installed at the beginning of the trail to restrict motorized vehicles from entering the trail system. The Buffalo Street Trail design is outlined on Sheet 21 of the Construction Drawings provided in Appendix A.

4.2.5 Belle Diamond Walking Trail

The *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) and ROD (EPA, 2006) outlined that a walking trail would be constructed to provide a close up of the Belle Diamond headframe, hoist building and its auxiliary steam hoist. In addition, a walking trail was to extend from the Belle Diamond Mine Yard south to the Belle Dump to overlook the Berkeley Pit. The Belle Diamond walking trail will consist of a four-foot wide graveled trail. In addition to accessing the overlook, a short section of walking trail will be constructed to the old chimney located west of the Belle Diamond Dump area. The Belle Diamond Walking Trail design is outlined on Sheets 23 and 24 of the Construction Drawings provided in Appendix A.

4.2.6 Pilot of Butte Mine Walking Trail

The *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) and ROD (EPA, 2006) outlined that a maintenance road would be constructed to provide access to the Granite Mountain Mine, Pilot of Butte Mine, and Speculator Mine for maintenance and guided tours. Instead of a maintenance road, a walking trail was designed to provide access to the Pilot of Butte Mine for guided tours. The walking trail was designed to be a 10-foot non-graveled trail that would accommodate the use of light weight vehicles to access for maintenance. Vehicles will be able to utilize the existing mine roads to access the Granite Mountain and Speculator Mines for maintenance. The Pilot of Butte Walking Trail design is outlined on Sheets 5, 6, and 8 of the Construction Drawings provided in Appendix A.

4.3 East Pacific Street Extension Design

Historically, East Pacific Street was utilized to access the Mountain Con Mine Yard. Currently, the existing East Pacific Street access has been blocked with an eight-foot security fence and a storm water control channel constructed through it. Due to the GMMA Trail alignment it was determined the East Pacific Street would need to be modified and extended into the northwest end to the future Mountain Con parking lot. This new alignment of East Pacific Street provides separation between the GMMA trail and the East Pacific Street Entrance to the parking lot. The extension of East Pacific Street was designed for 2-way traffic with a total road width of 24 feet. The design for the East Pacific Street extension is outlined on Sheets 25 and 26 of the Construction Drawings provided in Appendix A.

4.4 Parking Lot Designs

As part of this Phase II GMMA RAWP/FDR, four parking lots were developed and designed. The primary objectives of the parking lots were to provide access to the Mountain Con Mine yard/Foreman's Park area, provide multiple areas that allow easy access to and from the GMMA Trail system, and provide sufficient parking for future recreational events. The four designed parking lots are as follows: Center Street Parking Lot, Mountain Con Parking Lot, Buffalo Street Parking Lot, and the Wyoming Street Parking Lot. The design details for each of the parking lots are discussed in the following sections.

4.4.1 Mountain Con Parking Lot

The Mountain Con Parking Lot is located west of the Mountain Con headframe and will be accessed from East Pacific Street. The parking lot will provide access to the Mountain Con Mine Yard and Foreman's Park area. The parking lot covers a surface area of approximately 27,000 square feet and has been designed to hold 60 vehicles at full capacity. The parking lot drains to the west toward existing storm water control channels. The parking lot will be paved with three inches of compacted asphalt. In addition, 250 linear feet of concrete barriers will be installed on the south edge of the parking lot to separate GMMA trail users from the vehicles. The Mountain Con Parking Lot has been designed with two handicap parking spaces. The design for the Mountain Con Parking Lot is outlined on Sheet 27 of the Construction Drawings provided in Appendix A.

4.4.2 Center Street Parking Lot

The Center Street Parking Lot is located on the east end of Center Street in the north historical home area. The Center Street Parking Lot will provide access from the north to the Mountain Con Mine Yard/Foreman's Park Area and provides access to and from the GMMA Phases I and II Trail systems. The Center Street Parking Lot is designed with dimensions of 100 feet by 110 feet and has the capacity to hold 24 vehicles at full capacity. The Center Street Parking Lot is designed with one handicap parking space. The parking lot will be paved with three inches of compacted asphalt. The design for the Center Street Parking Lot is outlined in Sheets 28 to 30 of the Construction Drawings provided in Appendix A.

4.4.3 Buffalo Street Parking Lot

The Buffalo Street Parking Lot is located just east of Buffalo Street and will provide public access to and from the GMMA Phase II trail system. The Buffalo Street Parking Lot has been designed with dimensions of 55 feet by 30 feet and has a capacity for 6 vehicles. The Buffalo Street Parking Lot will be paved with three inches of asphalt. The asphalt will tie into the Buffalo Street pavement. The design for the Buffalo Street Parking Lot is outlined on Sheet 27 of the Construction Drawings provided in Appendix A.

4.4.4 Wyoming Street Parking Lot

The Wyoming Street Parking Lot is located east of Wyoming Street at the end of the Mineyard & Butte Hill Trail. The primary objective for the Wyoming Street Parking Lot is to provide public access to and from the GMMA Phase II Trail system. The parking lot is designed with the dimensions of 80 feet long by 50 feet wide and will be accessed by a 2-way traffic road off of Wyoming Street. The parking lot is designed with a capacity of seven vehicles with one handicapped space. The entry road and parking lot will be asphalted with three inches of compacted asphalt. The design for the Wyoming Street Parking Lot is outlined on Sheet 27 of the Construction Drawings provided in Appendix A.

4.5 Mountain Con Water Line Design

As outlined in Section 4.11, "Mountain Con Mine Yard/Foreman's Park Amenities," a public restroom will be installed at the Mountain Con Mine Yard. The installation of the restroom required that water be provided to the unit. In addition to supplying water to the restroom, it was requested that water be supplied to the upgradient end of the Foreman's Park area and to the gazebo area. The water supplied to the upgradient end of the Foreman's Park area will be utilized to irrigate flower gardens that will be planted by others in the future. The primary objective of supplying water to the gazebo area was to provide maintenance crews with water for cleaning the area.

Several alignments were considered in the design process for the water line extension. The design criteria were to minimize safety concerns, constructability, and the installation of the least amount of water main. Based on the design criteria, it was determined that the water main would extend from the existing six-inch polyvinyl chloride (PVC) water main on Wells Street. The designed water line would extend south of Wells Street 560 feet to a dead-end hydrant located southeast of the proposed public restroom as shown on Sheet 31 of the Construction Drawings provided in Appendix A. In addition to the water main extension, one service line will be run to the public restroom and two poly-service lines will run and terminate at the frost-free hydrants at the north end of Foreman's Park and at the gazebo as show on Sheet 31 of the Construction Drawings (Appendix A).

A comprehensive hydraulic analysis was completed to determine if the proposed Mountain Con water main extension would meet current fire flow requirements. Potable water would be supplied to the extension from the existing water main located on Wells Street. The Mountain Con water main would serve a recreational development and provide the fire flow requirement

for this type of neighborhood (1,000 gallons per minute [gpm] at a residual pressure of 20 pounds per square inch [psi] [ISO, 2006]). To determine the design flow rates and pressures for the fire hydrant to be located within the Mountain Con Mine Yard, flow test data, and static and open nozzle pressures were required for the hydrant design. To collect the required flow rate and static and nozzle pressure data, it was necessary to collect the actual data from two nearby City of Butte fire hydrant locations. The two fire hydrants utilized to collect the data were located between Wall Street and the Mountain Con alley and between Wall Street and Wells Street. City and County of Butte-Silver Bow test results are provided in Appendix C. Based on the hydraulic analysis calculations in Appendix C, the flow rate and pressure for the proposed fire hydrant meets the ISO, 2006 fire flow requirements.

The water main extension has been designed in accordance with Circular DEQ-1, "*Standards for Water Works*." Construction will be in accordance with DEQ-1, Sheets 31, D9, D10, D11 of the Construction Drawings provided in Appendix A, applicable sections of the *Montana Public Works Standard Specifications* (Montana Contractors Association, 2003), and the Technical Specifications provided in Appendix B.

4.6 Mountain Con Sewer Line Design

As outlined in Section 4.11, "Mountain Con Mine Yard/Foreman's Park Amenities," a public restroom will be installed at the Mountain Con Mine Yard. The installation of the restroom required that sewer line be provided to the unit. The Mountain Con sewer line extension has been designed to carry wastewater only. All storm water flows have been addressed in Section 4.8. The Mountain Con sewer line extension has been designed to be a gravity flow system that will be tied into the manhole near the corner of Minah Avenue and East Pacific Street. Steep terrain and existing structures on the Mountain Con site limited the alignment for the proposed sewer line extension. The two alignments considered involved running the sewer line directly under the Mountain Con headframe and the other running south of the headframe under the proposed pedestrian trail. Due to safety concerns of excavating near the shaft of the Mountain Con headframe and the unknown ground conditions, the sewer line was aligned under the pedestrian trail located south of the Mountain Con headframe (Sheet 32 of Construction Drawings provided in Appendix A).

In addition to the sewer line, the sewer system extension was designed with five manholes. Due to the existing poor condition of the brick manhole located within Minah Avenue, a new concrete manhole (MH1) will be installed to replace the existing manhole. Manholes MH2, MH3, and MH4 were designed at a depth of 8 feet below ground surface (bgs) and manhole (MH5), which is located closest to the public restroom was designed at a depth of 6.5 feet bgs. These design depths should provide the new sewer main extension adequate protection from freezing.

The minimum slope for the sewer main extension is 1.8 percent with a maximum slope of 9.0 percent. With these slopes, the velocities in the proposed sewer main are above the minimum recommended values to prevent settlement and below the maximum recommended values to prevent erosion and displacement (see Appendix D for calculations).

The designed sewer main extension serves primarily the Mountain Con Mine Yard and Foreman's Park area. The design criteria for the sewer line extension was the construction of a his and hers multi-stall (2) restroom facility. For the purposes of calculating peak flows in the system, it was conservatively assumed that there would be 500 visitors to the site per day. Based on this assumption and typical wastewater flow rates from Circular DEQ-4 (Table 5-3), the typical sewage flow was calculated to be 3.5 gpm (see attached calculation). A peaking factor of 3 was selected to represent the maximum flow (Dion, 1993). Based on this peaking factor, the peak flow from the area is calculated at 10.4 gpm.

The capacity of the proposed main extension (an 8-inch PVC main at a slope of 1.8 percent) is approximately 705 gpm (when flowing full). Assuming 80 percent of its capacity should not be exceeded, the usable capacity is 565 gpm. Therefore, the proposed sewer main extension can accommodate the projected peak flow with a factor of safety of 54. Sewer line calculations are provided in Appendix D.

The project is designed in accordance to the Circular DEQ-2, "*Design Standards for Wastewater Facilities*." Construction will be in accordance with DEQ-2 requirements, the Construction Drawings provided in Appendix A, applicable sections of the Montana Public Works Standard Specifications (Montana Contractors Association, 2003), and Technical Specifications provided in Appendix B.

4.7 GMMA Maintenance Road Design

The *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) and ROD (EPA, 2006) indicated that maintenance roads would be developed for the future maintenance activities associated with the GMMA. There are several existing roads within the GMMA that will be modified for use or utilized in their current conditions. The primary maintenance road at the GMMA can be entered from Buffalo Street and exited at the Mine Waste Repository entrance (Sheets 33 to 42 of the Construction Drawings provided in Appendix A). This primary maintenance road will be modified from its current conditions. Modifications will consist of debris removal, minor filling and grading, culvert installations, and construction of storm water channels (see Section 4.8). In addition to this primary maintenance road, the existing road across the Green Mountain Shaft embankment will remain in its current condition and provide access to the Mountain Con Mine Yard/Foreman's Park area (Sheet 34 of the Construction Drawings provided in Appendix A).

The *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) and ROD (EPA, 2006) also indicated that a maintenance road would be constructed to the Granite Mountain Mine and Pilot of Butte Mine for future maintenance of the structures if needed.

The primary maintenance road as shown on Sheets 33 to 37 of the Construction Drawings provided in Appendix A has been designed for 1-way traffic. The maintenance road has been designed with a width of 16 feet with 2:1 (H:V) slopes on each side with a storm water control channel located on the north side of the maintenance road (Sheet D17 of the Construction Drawings provided in Appendix A). The maintenance road between Stations 0+00 to 7+00 will

be surfaced with road base materials as specified in Technical Specification - 2515 "Base Course" in Appendix B. The maintenance road between Stations 7+00 to 49+00 will be surfaced with existing materials, cut materials from the construction of the maintenance road and/or storm water control channel and/or fill materials from the Mountain Con Borrow Area, as necessary.

The primary maintenance road has been designed with grades ranging from 0.3 percent to 10.22 percent (Sheet 33 to 36 of the Construction Drawings provided in Appendix A). The maximum grades do exceed 10 percent; however, this is a maintenance road that will support construction activities and will experience minimal use by light duty after construction.

The storm water channels associated with primary maintenance roads have been designed for the 25-year, 24-hour event. The storm water channel designs associated with the maintenance road are discussed in detail in Section 4.8. A minimum burial depth of 2 feet has been designed at each of the culvert crossings discussed in Section 4.8. The designed culverts consist of 18-inch high density polyethylene (HDPE) pipe, with exception to the culvert at the Moose Channel. The culvert at the Moose Channel will be a 36-inch arched reinforced concrete pipe culvert. Additional fill materials may be placed over culverts during construction to support construction activities and removed at the completion of construction.

4.8 GMMA Phase II Storm Water Control Design

Storm water improvements completed for the GMMA and elsewhere under the BPSOU Storm Water TCRA, (UAO Docket No. 95-58) routed storm water runoff from portions of the Butte Hill to the Berkeley Pit through a system of channels and sedimentation basins. Storm water within the GMMA currently flows to the Berkeley Pit through underground shafts or overland flows. Consistent with this strategy, additional storm water features constructed in the GMMA will drain toward the Berkeley Pit. There are six drainages that will be addressed in the reclamation efforts at the GMMA. They are as follows: Bell Diamond, Granite Mountain Mine, Mine Waste Repository, Moose and Green Mountain Shaft, Mountain Con and Kelley, and the Pilot of Butte. The drainages to be addressed under this GMMA Phase II RAWP/FDR will be the Bell Diamond, the Granite Mountain Mine, the Mine Waste Repository, the Mountain Con Mine, and the Pilot of Butte.

The design objective is to convey the storm water flows around the Granite Mountain Mine, Mountain Con Mine, and Pilot of Butte areas to the Berkeley Pit by constructing storm water control channels, a storm water drain system in the Mountain Con Mine Yard, and earthen berms. The storm water flows from the area upgradient of the modified Moose Channel will be collected and conveyed by the Moose Channel and ultimately discharged to the Berkeley Pit. Storm water flows from the Mountain Con Mine Yard will be collected by a storm drain system and then conveyed to the Berkeley Pit via the Mountain Con Channel and Kelly A Channel. Storm water flows from the Granite Mountain Mine will be diverted by repairing the earthen berm currently existing upgradient of the site and extending a new berm around the south end of the Granite Mountain Mine site to prevent further damage to the historical structures therein. Storm water flows from the Pilot of Butte will be addressed by utilizing two separate storm water controls. The first storm water control will be the construction of two earthen berms located to the northwest and east of the existing Pilot of Butte site which will effectively divert the majority

of the upgradient storm water run-on. In addition, a storm water control channel will also be constructed around the structures located at the Pilot of Butte site to capture and transport any remaining storm water run-on away from the site.

The Natural Resources Conservation Service (NRCS) Technical Release 55 (TR-55) Urban Hydrology for Small Watersheds method was used to calculate Q_p . The program HYCHL, distributed by the Federal Highway Administration (FHWA) under the HYDRAIN Drainage Design System (FHWA, 1999) was used to determine the channel sizes and lining types for the storm water controls.

The total estimated rainfall for a 25-year, 24-hour storm event at the GMMA was determined to be 2.2 inches, using NOAA Western U.S. Precipitation Frequency Maps. A Type II storm distribution was utilized in prior hydraulic calculations in the Butte area and was used to determine Q_p . Storm water design calculations are provided in Appendix E.

The following sections describe the design for the storm water controls for the GMMA Phase II RA.

4.8.1 Mountain Con Mine Yard

A storm water runoff analysis of the Mountain Con Mine Yard drainage area was completed to determine the size of a standard storm water drain/catch basin and the piping to transport the collected storm water from the 25-year, 24-hour, Type II storm event under a paved walking trail and discharge it to a tree pod located downgradient of the mine (to the south) (see Sheet D22 of the Construction Drawings provided in Appendix A).

Based on the storm water calculations, a 24-inch catch basin was selected to capture the storm water runoff from the previously mentioned drainage area. A 12-inch HDPE smooth pipe was then selected to be installed under the proposed walking trail. The sizing of the storm drain was based on a calculated peak discharge value of 1.27 cfs for the 25-year, 24-hour, and Type II storm event. The 12-inch HDPE pipe was selected after calculating its full capacity discharge rate of 7.28 cfs. As shown herein, the full capacity discharge rate of the 12-inch PVC pipe is more than adequate to handle the anticipated runoff from the drainage area. The 12-inch diameter HDPE pipe was also selected for maintenance. The calculations associated with the storm drain and the storm drain discharge pipe are included in Appendix E.

The 12-inch discharge pipe from the storm drain will transport the collected storm water from the Mountain Con Mine Yard to a tree pod located southwest (downgradient) of the mine yard. This design feature will allow the storm water runoff from the mine yard to be used as irrigation water for the associated trees and other vegetation present in the tree pod. In the event that the volume of water discharged to the tree pod surpasses the soil absorption capacity, excess water discharge from the storm drain pipe to the tree pod will be allowed to sheet flow downgradient to the Mountain Con Channel, from which point it will be transported to the Berkeley Pit.

4.8.2 Granite Mountain Mine Drainage Area

The primary objective in constructing the storm water control berm around the Granite Mountain Mine is to curtail the volume of water that has been flowing into the mine site during past precipitation events. The storm water control berm will serve to effectively divert the storm water runoff from the surrounding drainage areas away from the Granite Mountain Mine. This will reduce the amount of damage to the site that has been previously caused by uncontrolled storm water run-on flows.

The watershed area that drains to the Granite Mountain Mine has been calculated to be approximately 22 acres. Runoff from the mine area watershed will be diverted away from the mine site by repairing approximately 600 feet of the existing earthen storm water control berm located northeast of the mine site and constructing approximately 350 feet of additional earthen storm water control berm around the southern portion of the site (see Sheet 43 of the Construction Drawings provided in Appendix A). The earthen storm water control berm will be constructed to a minimum height of three feet at its center with a three-foot wide top. The sides of the berm will slope at 3:1 (H:V) resulting in a minimum overall berm width of 21 feet if built on a flat surface (the berm will be constructed as described in Section 02205: Fill Materials and Placement of the Technical Specifications provided in Appendix B). Because the runoff from the Granite Mountain Mine watershed will be moving toward the mine under sheet flow conditions, the previously specified berm will effectively divert the storm water flows away from the Granite Mountain Mine site and direct it toward the Berkeley Pit.

4.8.3 Pilot of Butte Drainage Area

Storm water controls for the Pilot of Butte will consist of constructing two earthen storm water berms located on the adjacent upgradient waste rock dumps as well as the construction of an unlined trapezoidal storm water control channel around the structures at the site.

The design depth of the channel portion of the Type II Storm Water Berms (see Detail 43 on Sheet D18 of the Construction Drawings provided in Appendix A) will be approximately 1.5 feet. The height of the actual berm portion of the Type II Storm Water Berms will also be approximately 1.5 feet. The total height from the bottom of the channel to the top of the berm will be three feet. The material that is generated from constructing the channel portion of the Type II Storm Water Berms will be used in the construction of the berm portions of the control structures. One section of the Type II Storm Water Berm will extend approximately 700 feet as it is located near the eastern edge of the site (see Sheet 43 of the Construction Drawings provided in Appendix A). The peak discharge for this section of Type II Storm Water Berm has been calculated as being 12.4 cfs (Appendix E). This section of Type II Storm Water Berm will divert storm water to the southeast of the Pilot of Butte site.

The second section of Type II Storm Water Berm will extend approximately 1,040 feet and is located near the northwestern edge of the site (see Sheet 43 of the Construction Drawings provided in Appendix A). This section of the Type II Storm Water Berm will divert storm water to the west of the Pilot of Butte site into an existing drainage. This structure will be constructed

to the same details that have been previously specified for the first section of Type II Storm Water Berm.

The unlined trapezoidal storm water control channel that will be constructed around the actual structures at the Pilot of Butte site will be approximately 500 feet in length. This control channel will begin near the northern most point of the site and extend around the entire eastern side. This channel will divert storm water around the structures located at the Pilot of Butte site and discharge into a low lying area in the southern portion of the site (see Sheet 44 of the Construction Drawings provided in Appendix A). The peak discharge for this storm water control channel has been calculated as being 9.3 cfs (Appendix E). The channel will have a top width of 10 feet, a bottom width of 6 feet, a total depth of 1 foot, and side slopes of 2:1 (H:V). The maximum depth at peak flow of the unlined trapezoidal channel at a slope of 1 percent configuration is 3.9 inches with a free board of 8.1 inches.

The storm water control structures for the Pilot of Butte site can be found on Sheets 43 and 44 of the Construction Drawings provided in Appendix A.

4.8.4 Maintenance Road Channels

The primary objective of the Maintenance Road Channel is to route storm water flows to the Berkeley Pit. The drainages for the maintenance road were divided into subareas for each of the channels. Storm water calculations showed that the peak discharge for the Maintenance Road culverts ranged from 2 to 8 cfs. Therefore, all the channels were designed for 8 cfs. Subarea 5 indicated that a peak discharge of 12.2 cfs (Appendix E) would report to the modified Moose Channel. This flow was incorporated in the design in the *Final Granite Mountain Memorial Area (GMMA) Phase I Remedial Action Work Plan/Final Design Report (RAWP/FDR)* (Atlantic Richfield Company, 2008) and will not impact the 36-inch reinforced concrete pipe culvert being installed in 2008.

The channel types for the maintenance road to be constructed under this GMMA Phase II RAWP/FDR were based on constructability, slope, and channel stability. The channel types and dimensions for the maintenance road consist of un-lined v-channel, un-lined trapezoidal channel, and a grouted Type I riprap trapezoidal channel. The design dimensions for the channel types can be found on Sheet D18 of the Construction Drawings provided in Appendix A. The maximum depth at peak flow of the unlined v-channel at a slope of 4 percent configuration is 0.15 feet with a free board of 1.85 feet. The maximum depth at peak flow of the unlined trapezoidal channel at a slope of 1.5 percent configuration is .32 feet with a free board of 1.68 feet. The maximum depth at peak flow of the grouted Type I riprap trapezoidal channel at a slope of 13.8 percent configuration is 0.24 feet with a free board of 1.76 feet. The design calculations for the maintenance road channels are provided in Appendix E.

The Maintenance Road Channel design can be found on Sheets 33 to 42 of the Construction Drawings provided in Appendix A.

4.8.5 Mine Waste Repository Drainage Area

The design of the Mine Waste Repository submitted to the Agencies in 2005 incorporates a storm water control channel that will capture all of the runoff from the approximate 10-acre area upon which the final Mine Waste Repository will reside (Atlantic Richfield Company, 2005). This storm water control channel will empty on the eastern side of the repository, from which point the storm water will travel in a southerly direction towards the Berkeley Pit. The runoff produced over the area of the Mine Waste Repository by the 25-year, 24-hour storm event will be diverted to the Berkeley Pit. The construction of this channel will be conducted at the completion of the Mine Waste Repository.

4.9 GMMA Phase II Reclamation Design

As outlined in the *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) and ROD (EPA, 2006) the areas requiring reclamation in the GMMA were broken down into the following reclamation cap types:

1. Standard Reclamation;
2. Standard Reclamation with Alternate Seed Mix;
3. Reclaim/Enhance;
4. Reclaim/Enhance with Alternate Seed Mix;
5. Native Plant Enhancement;
6. Previously Reclaimed;
7. No Reclamation;
8. Pavement;
9. Road Base; and
10. Riprap.

The reclamation designs in this GMMA Phase II RAWP/FDR were based on Figure 3 in Appendix E-4 of the *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) and site reconnaissance conducted by the Atlantic Richfield Company (Atlantic Richfield). The reclamation design for this GMMA Phase II RAWP/FDR consists of 9.3 acres of Standard Reclamation, 2.7 acres of Standard Reclamation with an Alternate Seed Mix, 6.9 acres of Reclaim/Enhance, 3.5 acres of Reclaim/Enhance with Alternate Seed Mix, 9 acres of Previously Reclaimed areas, 1.7 acres of Natural Plant Enhancement, 3.5 acres of Pavement (includes roads, parking lots, and trails to be paved), 1.0 acre of Road Base areas, 0.1 acre of Rock Cover, and 8 acres requiring No Reclamation (Sheets 47 and D1 of the Construction Drawings provided in Appendix A). The following is a detailed description of the reclamation cap types that will be utilized at the GMMA.

Standard Reclamation - The BPSOU standard reclamation design consists of a continuous layer of lime or lime rock (if the pH of the surface soils to be covered are less than 5.5 standard units [s.u.]), 18 inches of cover soil, organics (as necessary), and reseeding. To obtain an in-place thickness of 18 inches, 22 inches of loose cover soils will be installed. Bedrock outcropping and/or boulders greater than 18 inches in size will be left in place and cover soil

placed around them. The RD in these areas will also include the appropriate Best Management Practices (BMPs) (Sheet D67 of the Construction Drawings provided in Appendix A). Reclamation in these areas will be conducted according to the Butte Hill Revegetation Specifications (Technical Specifications in Appendix B).

Standard Reclamation with Alternate Seed Mix - The BPSOU standard reclamation with an alternate seed mix design will be consistent with that of a standard reclamation but will utilize an alternate seed mix. The areas designated with a Standard Reclamation with an Alternate Seed Mix design are located in the Mountain Con Mine yard northwest of the Foreman's Park area (Sheet 47 of the Construction Drawings in Appendix A). The future use in these areas will be for public recreation. The seed mix outlined in the Butte Hill Revegetation Specifications (Technical Specifications in Appendix B) results in tall bunch grasses that are protective but are not suited very well for public events and recreation. It was a request by Butte-Silver Bow that a drought tolerant turf grass seed mix be utilized in the Mountain Con Mine Yard area. This alternate seed mix would provide a short, drought tolerant, sod generating turf grass that could be mowed once or twice a year for public events. The following table is the proposed alternative seed mix.

**GMMA Phase II
Alternate Seed Mix**

SPECIES	COMMON NAME	LBS PLS/ACRE	VARIETY
Grasses			
<i>Schedonorus</i>	Tall Fescue	12.0	Alta
<i>Festuca ovine</i>	Sheep Fescue	6.0	Black Sheep
<i>Festuca rubra</i>	Red Fescue	8.0	Pennlawn
<i>Poa compressa</i>	Canada Bluegrass	8.0	Monocot
TOTAL		34.0	
Forbs			
<i>Linum lewisii</i>	Lewis Blue Flax	0.5	
TOTAL		0.5	
	TOTAL	34.5	

LBS PLS/ACRE – pounds per live seed per acre

The RD in these areas will also include the appropriate BMPs (Sheet D67 of the Construction Drawings provided in Appendix A). Reclamation in these areas will be conducted according to the Butte Hill Revegetation Specifications (Technical Specifications in Appendix B) but utilizing the seed mix identified above.

Reclaim/Enhance - Reclaim/Enhance will be utilized in areas that may have been impacted by mine activities, but are not actual mine wastes or waste rock. In these areas there may be suitable soil present, which may reduce the amount of growth media materials that need to be added. Work in these areas will consist of weed spraying, smoothing and grading the existing topography, and the installation of six inches of cover soil. To obtain an in-place thickness of six

inches, eight inches of loose cover soils will be installed. The RD in these areas will include the necessary BMPs (Sheet D67 of the Construction Drawings provided in Appendix A).

Reclaim/Enhance with Alternate Seed Mix - The BPSOU Reclaim/Enhance reclamation with an alternate seed mix design will be consistent with that of a Reclaim/Enhance reclamation but will utilize the alternate seed mix discussed in the above Standard Reclamation with an Alternate Seed Mix Section. The Reclaim/Enhance reclamation with an Alternate Seed Mix design is located in the Mountain Con Mine Yard south of the Foreman's Park area (Sheet 47 of the Construction Drawings provided in Appendix A).

Native Plant Enhancement – Native Plant Enhancement areas are largely undisturbed, contain relatively little mine waste, and have natural recovery of vegetation occurring. The reclamation activities focus on preserving existing non-weedy vegetation, inhibiting weed growth, and promoting growth of desirable species. Work in these areas will consist of weed spraying, fertilizing, inter-seeding, and addition of soil in small bare spots. Areas requiring Native Plant Enhancement are located in the Foreman's Park area and include 1.7 acres. A detailed discussion of the work that will be conducted at the Foreman's Park area is provided in Section 4.10.

Previously Reclaimed - There are approximately nine acres of previously reclaimed areas located within the GMMA. These areas will be preserved to the extent possible. The construction of the Phase II GMMA Trail adjacent to the previously reclaimed areas will disturb a portion of the previously reclaimed area. The footprint located outside the constructed GMMA Trail will receive a standard reclamation. Other areas disturbed by construction efforts will receive a standard reclamation.

No Reclamation – Areas designated as restricted access and reserved as a Historic Mining District will not require reclamation and will remain in their existing state and preserved as historical landscape. In addition, the areas located southeast and east of the Mountain Con Mine Yard/Foreman's Park area will not receive reclamation. The areas will be reclaimed in the future by others.

Pavement – Paved areas consist of the GMMA access road, GMMA Memorial Parking Lot, East Pacific Street extension, Center Street Parking Lot, Buffalo Street Parking Lot, Mountain Con Parking Lot, Wyoming Street Parking Lot, GMMA Phase I and II Trails, and the Top of the World Trail. All paving will be completed at the completion of the GMMA Phase II RA construction activities. The design for pavement for the public streets and trails will consist of 4 inches of compacted asphalt (Sheets 47 and D1 of the Construction Drawings provided in Appendix A). All parking lots will be paved with 3 inches of compacted asphalt (Sheets 27, 28, and D1 of the Construction Drawings provided in Appendix A).

Road Base - Road base materials will be utilized along the historic railroad grade located between the Mountain Con Hoist House and the Mountain Con headframe (Sheet 47 of the Construction Drawings provided in Appendix A). This area will be utilized as a walking trail and will be equipped with rest areas as outlined on Sheet D5 of the Construction Drawings provided in Appendix A. In addition, road base materials will be placed around the Mountain

Con Hoist House (Sheet 47 of the Construction Drawings provided in Appendix A). The reclamation in these areas will consist of weed spraying, grading, and the addition of six inches of compacted road base materials.

Rock Cover - There is approximately 0.1 acre of rock cover that will be installed on the southern edge of the Center Street Parking Lot (Sheet 28 of the Construction Drawings provided in Appendix A). The rock cover will consist of grading and the placement of 6 inches of Type III riprap (Sheet D1 of the Construction Drawings provided in Appendix A).

Riprap – Riprap will be utilized in the construction of the storm water controls. The riprap will be 18 inches thick and installed as specified on the Construction Drawings provided in Appendix A.

4.10 Foreman's Park Area

The Foreman's Park area is located on the east side of the Mountain Con Mine Yard and consists of the areas surrounding the remains of the mine foreman's home. The area consists of the remnants of the home's yard with trees, grass and old foundation walls. The Foreman's Park area has several old roads within the area that will be incorporated into the trail systems discussed in Section 4.2. The reclamation for the Foreman's Park area is Native Plant Enhancement that will consist of the following:

- Pruning trees and shrubs to remove dead materials and provide access along trails;
- Planting of trees and shrubs for aesthetic purposes;
- Removal of pine needle and duff materials from historic stone trails;
- Weed spraying and removal;
- Fertilizing existing vegetation; and
- Seeding of bare soils where determined necessary.

In addition to the native plant enhancement, several amenities will be added to the Foreman's Park area. The amenities will consist of a gazebo, barbeque grills, benches, bicycle rack, and picnic tables. The amenities to be installed at the Foreman's Park area are shown on Sheets 49 and 50 of the Construction Drawings provided in Appendix A. The amenities are further discussed in Section 4.11.

4.11 Mountain Con Mine Yard/Foreman's Park Amenities

The Mountain Con Mine Yard and the Foreman's Park area have been designated for full-time public access as discussed in Section 1.1. In conjunction with the reclamation of these areas and the construction of the GMMA Phase II Trail system, many public amenities will be installed within the GMMA Phases I and II project areas to enhance public use of the areas. The amenities consist of a gazebo at the Foreman's Park area, public restroom in the Mountain Con Mine Yard, viewpoint at the Mountain Con headframe, and numerous benches, trash receptacles, picnic tables, bike racks, barbeque grills, etc. The amenities to be installed are shown on Sheets 49 and 50 of the Construction Drawings provided in Appendix A. The following sections discuss the amenities in further detail.

4.11.1 Foreman's Park Gazebo

In the southern portion of the Foreman's Park area, a gazebo will be constructed in the location of the former mine foreman's house as shown on Sheet 51 of the Construction Drawings provided in Appendix A. The gazebo will be a 30-foot by 60-foot custom Cheyenne Model provided by Classical Recreation Systems, Inc. The gazebo footings were designed for a 40-pound snow load and 90 mile per hour (mph) winds. The gazebo will be constructed on a 40-foot by 70-foot concrete pad with barbeque grill located on the west and east sides. A plan view of the gazebo layout is shown on Sheet 51 of the Construction Drawings provided in Appendix A. The gazebo will also be equipped with power outlets and lighting. The structural designs for the gazebo can be found on Sheets D38 to D43 of the Construction Drawings provided in Appendix A. The electrical design for the gazebo can be found on Sheets D72 through D76 of the Construction Drawings provided in Appendix A. The gazebo will be constructed according to the manufacturer's specifications and the Technical Specifications provided in Appendix B.

4.11.2 Mountain Con Public Restroom

A public restroom will be installed along the east edge of the Mountain Con Mine Yard and will be served by the water and sewer lines discussed in Sections 4.5 and 4.6. The public restroom will be a precast facility (Montrose) provided by CXT Precast Products. The restroom has been designed with multi-use men and women facilities and an open front porch. The restroom conforms to the International Building Codes and will be equipped with water, sewer, and electrical power. The public restroom design can be found on Sheets D30 through D37 of the Construction Drawings in Appendix A. The electrical design can be found on Sheets D72 through D76 of the Construction Drawings provided in Appendix A. The public restroom will be installed according to the manufacturer's specifications and the Technical Specifications provided in Appendix B.

4.11.3 Mountain Con Headframe View Port

A view port will be constructed in the existing doorway located on the south side of the Mountain Con headframe to allow the public to view the headframe structures. A metal and clear Lexan Margard window will be installed in the existing 9-foot doorway located on the south side of the headframe. The clear Lexan Margard has been design to withstand the force from a baseball bat. All the metal will be finished in black powder coat. The design for the Mountain Con viewport can be found on Sheet D44 of the Construction Drawings provided in Appendix A. The view port will be constructed utilizing the Technical Specifications provided in Appendix B.

4.11.4 Park Amenities (Picnic Tables, Bike Racks, Barbeque Grills, Benches, etc.)

Numerous park and trail amenities will be installed throughout the GMMA Phases I and II project areas. The amenities will consist of picnic tables, benches, trash receptacles, grills, bike racks, pedestrian gates and historical feature signage. The locations for these amenities can be found on Sheets 49 and 50 of the Construction Drawings provided in Appendix A. The

amenities will be installed per the manufacturer's specifications and/or the Technical Specifications provided in Appendix B.

4.11.5 Mountain Con Yard/Foreman's Park Electrical System

Currently there is electrical service to the Mountain Con Hoist House and the Mountain Con headframe. This service is utilized to provide future electrical requirements at the Mountain Con Hoist House and to light the Mountain Con headframe. The installation of the public restroom and the installation of lights and outlets at the Foreman's Park gazebo will require the installation of an additional electrical service to the public restroom. The electrical service will be installed by NorthWestern Energy from a source to be determined to the public restroom. The electrical service will provide the power to the public restroom panel (see Sheet D37 of the Construction Drawings provided in Appendix A) and the gazebo outlets and lighting (see Sheets D72 through D76 of the Construction Drawings provided in Appendix A).

The electrical design is outlined on Sheets D72 through D76 of the Construction Drawings provided in Appendix A. All electrical work will be installed and will conform to local, state, and federal electrical codes and the Technical Specifications provided in Appendix B.

4.12 Granite Mountain Memorial Upgrades/Modifications

The Granite Mountain Memorial was constructed to honor and remember the 168 men who lost their lives in the June 1917 mine disaster. Atlantic Richfield has worked with Butte-Silver Bow County to ensure the design of the Granite Mountain Memorial upgrades and modifications are consistent with the Butte-Silver Bow Granite Mountain Overlook Plan submitted to Atlantic Richfield in February 2001. Since the submittal of the Butte-Silver Bow Granite Mountain Overlook Plan in February 2001, several modifications to the plan were requested by the Granite Mountain Memorial Board in their letter to Butte-Silver Bow on March 29, 2007. Therefore, the design of the Granite Mountain Memorial upgrades and modifications were based on the Butte-Silver Bow Granite Mountain Overlook Plan (February 2001) and the letter from the Granite Mountain Memorial Board dated March 29, 2007. Based on these documents, the Granite Mountain Memorial upgrades and modifications have been designed and incorporated in the 3-dimensional figure of the completed Granite Mountain Memorial shown on Sheet 53 of the Construction Drawings provided in Appendix A. All work conducted at the Granite Mountain Memorial will be in accordance with the Technical Specifications provided in Appendix B.

The following sections discuss in detail what upgrades and details will be conducted at the Granite Mountain Memorial.

4.12.1 North Quadrant

The north quadrant of the Granite Mountain Memorial has been completed and does not require any work within the quadrant itself. However, to support the iron railing system (discussed in Section 4.12.5) that was designed to run along the northwest and southwest grade beams, it will be necessary to remove the existing grade beam and replace it with a new grade beam. The

upgrades and modifications designed for the north quadrant are shown on Sheet 54 of the Construction Drawings provided in Appendix A.

The work in the north quadrant will consist of the following:

- Removal and installation of the northwest grade beam; and
- Installation of trash receptacle in the northeast corner of the north quadrant.

All work will be performed as outlined in the Technical Specifications provided in Appendix B.

4.12.2 East Quadrant

The east quadrant of the Granite Mountain Memorial was the original quadrant completed and contains many of the engraved personalized bricks. After several years, the brick panels settled within the panels. To avoid the settlement of the bricks in the north quadrant, concrete was poured under the bedding sand and drain holes installed to drain the moisture from the panels. This worked very well in the north quadrant and so the east, south, and west quadrants have been designed with a concrete pad and drain holes under the Miner Logo and Personalized Brick panels (see Sheet D53 of the Construction Drawings provided in Appendix A). The installation of concrete pads under the brick panels in the east quadrant required the removal of all the bricks. The installation of the concrete pads under the brick panels in the east quadrant was completed in 2008 by an Eagle Scout as an Eagle Scout Project. In addition to the installation of the concrete pads, the brass floor plaque was cleaned, polished, and sealed.

The plaque on the east quadrant pedestal will be removed and replaced with a larger plaque with the same poem printed on it. The new plaque will be as large as possible and still fit on the pedestal. Plaque size and print size will be determined by Atlantic Richfield representatives, Butte-Silver Bow representatives, and Mrs. Gerry Walters of the Granite Mountain Memorial Board. In addition, there are five pillars to the north and five pillars to the south of the east quadrant pedestal. Each pillar has a space for a plaque on the top and picture on the front. All the pillars are completed with exception of the fifth pillar to the north and the first pillar to the south. A picture and plaque will be installed on the fifth pillar to the north acknowledging EPA's involvement and support of the Monument. A picture will be installed on the front of the first pillar to the south. Plaques and pictures will be finalized by Atlantic Richfield representatives, Butte-Silver Bow representatives, and Mrs. Gerry Walters of the Granite Mountain Memorial Board.

The upgrades and modifications designed for the east quadrant are shown on Sheet 55 of the Construction Drawings provided in Appendix A.

4.12.3 South Quadrant

The existing south quadrant has not been completed and will require complete construction. The design for the south quadrant can be found on Sheet 56 of the Construction Drawings provided in Appendix A.

The work in the south quadrant will consist of the following:

- Removal and installation of the southwest grade beam;
- Installation of the steel flat bar grid system;
- Installation of concrete pad for floor;
- Installation of flag pole for state and county flags;
- Installation of granite core panels;
- Installation of personalized and miner logo brick panels (blank bricks will be provided and utilized for later engraving); and
- Installation of trash receptacle in southwest corner of quadrant.

All work will be performed as outlined in the Technical Specifications provided in Appendix B.

4.12.4 West Quadrant

The existing west quadrant has not been completed and will require complete construction. The design for the west quadrant can be found on Sheets 53 and 57 of the Construction Drawings provided in Appendix A.

The work in the west quadrant will consist of the following:

- Removal and installation of the northwest grade beam;
- Installation of the steel flat bar grid system;
- Installation of concrete pad for floor;
- Installation of granite sign;
- Installation of granite core panels;
- Installation of personalized and miner logo brick panels (blank bricks will be provided and utilized for later engraving);
- Installation of two free standing 8-foot benches; and
- Installation of an ADA accessible ramp.

All work will be performed as outlined in the Technical Specifications provided in Appendix B.

4.12.5 Gallus Frame and Railing System

The Butte-Silver Bow Granite Mountain Overlook Plan submitted to Atlantic Richfield in February 2001 had 26 flag poles and lattice work designed along the northwest and southwest grade beams. The flag poles were to display the 26 ethnic flags representing the ethnic backgrounds of the many miners that worked in the Butte Mines. However, it was determined that the seasonal wind conditions at the Granite Mountain Memorial would result in replacing the flags on an annual basis. In the Granite Mountain Memorial Board letter to Butte-Silver Bow on March 29, 2007, they requested that the 26 flag poles be removed from the plan and the ethnic flags be constructed of polymer and placed on the northeast and southeast interior walls of the Granite Mountain Memorial and the lattice be replaced with a gallus frame located on the north and south corner pillars with a rock barricade along the northwest and southwest grade beams. Based on the Butte-Silver Bow Granite Mountain Overlook Plan submitted to Atlantic Richfield

in February 2001 and the Granite Mountain Memorial Board request on March 29, 2007, a gallus frame and railing system was designed for along the northwest and southwest grade beams. The gallus frame and railing system provides entrance to the memorial from the west at one location, aides in the potential installation of a surveillance system, provides some shelter from wind, and will minimize the drifting of snow on the memorial during the winter months.

The design of the gallus frame and railing system can be found on Sheet 59 of the Construction Drawings provided in Appendix A. The gallus frame is designed with a height of 14.5 feet above ground surface and a railing height of 4 feet. The gallus frame and railing system has been designed to withstand wind speeds of 90 mph. The cut outs will be constructed in 1/8-inch steel with expanded metal on the backside. Electronic copies of the cut outs will be provided to the supplier. The entire gallus frame and railing system will be finished with black powder coat and installed in sections at the site. The construction, finishing, and installation of the gallus frame and railing system will be as outlined in the Technical Specifications provided in Appendix B.

4.12.6 Ethnic Flags

In the Granite Mountain Memorial Board letter to Butte-Silver Bow on March 29, 2007, it was requested that the 26 flag poles be removed from the plan and the ethnic flags be constructed of polymer and placed on the northeast and southeast interior walls of the Granite Mountain Memorial. Therefore the ethnic flags will be constructed of a polymer material from Polymer Industries and supplied by 21st Century Plastics located in Missoula, Montana. There are a total of 26 ethnic flags that will be installed at the Granite Mountain Memorial. Thirteen flags will be equally spaced along the north interior and south interior wing walls. Name tags for each of the flags will be placed below the flags. Granite cores will be placed on the north and south interior walls using concrete epoxy. The design for the ethnic flags is shown on Sheet 58 of the Construction Drawings provided in Appendix A. The installation of the ethnic flags and granite cores along the north and south interior wing walls will be in accordance with the manufacturer's specifications and the Technical Specifications provided in Appendix B.

4.12.7 Surveillance System

Currently there is a sign located at the Granite Mountain Memorial indicating that there is a surveillance system, however there is not. The Granite Mountain Memorial Board letter dated March 29, 2007 requested that a surveillance system be installed at the Granite Mountain Memorial. During the design process, it was not determined who would be responsible for the power and the long-term maintenance of the surveillance system. It was also determined that it would be difficult to identify vehicles and individuals unless the surveillance tapes were viewed immediately after an incident. It was also thought that the installation of flood lights at the memorial would deter any vandalism at the Granite Mountain Memorial (see Section 4.12.9). Therefore, a surveillance system has not been designed for the Granite Mountain Memorial. The electrical design discussed in Section 4.12.9 provides for the installation of a surveillance system in the future, if necessary.

4.12.8 Audio System

The Granite Mountain Memorial Board letter dated March 29, 2007 requested that an audio system be incorporated into the modifications at the Granite Mountain Memorial. The audio system would be designed to tell visitors the story of the fire and the impact the tragic event had on the community of Butte and other Montana cities. The board requested that the audio system be located on the first pillar north of the east quadrant pedestal. The audio system will be in a vandal-proof cabinet (see Sheet 53 of the Construction Drawings provided in Appendix A).

The audio system will consist of the following:

- Gilderfluke Sd-25 Digital Audio Playback Device;
- Sonance Mariner 52 Indoor/Outdoor Speakers;
- Custom cabinet for the speaker system;
- Custom metal door for opening in first pillar north of east quadrant pedestal (will be utilized to house equipment); and
- High security locks.

The audio system will be supplied and installed by Poindexter's Audio-Visual Environments located in Bozeman, Montana.

An initial script for the audio system was provided by Mrs. Gerry Walters. Atlantic Richfield representatives, Butte-Silver Bow representatives, Mrs. Gerry Walters, and Poindexter's representatives will finalize the script to be utilized on the audio system. It is estimated that there will two to four different audio tracks produced for use on the audio system. Poindexters will retain professional talent to read and record the scripts. Poindexters will provide the layering of sounds, editing of materials and the mixing of the audio tracks.

The installation of the audio system will be in accordance with the manufacturer's specifications and the Technical Specifications provided in Appendix B.

4.12.9 Granite Mountain Memorial Electrical System

Currently there are no existing electrical services at the Granite Mountain Memorial. To operate the audio system discussed in Section 4.12.8, the lighting at the memorial, and the potential installation of a future surveillance system at the Granite Mountain Memorial, an electrical service would be required at the Granite Mountain Memorial. A meter base will be installed on the south exterior wing wall as outlined on Sheet D63 of the Construction Drawings provided in Appendix A. Electrical conduits will be run along the base of the north and south exterior wing walls to provide service to the audio system, Appleton flood lights, and the cabinet and camera locations for the potential installation of surveillance system. The electrical system has been designed to local, state, and federal electrical codes. The electrical service line to the meter box will be installed by NorthWestern Energy.

The electrical design is outlined on Sheets D62 to D64 of the Construction Drawings provided in Appendix A. All electrical work will be installed and conform to local, state, and federal electrical codes and the Technical Specifications provided in Appendix B.

4.13 Institutional Controls

Institutional controls identified in the *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) consisted of 8-foot security fences and a low profile fence. The ICs designed in this Phase II GMMMA RAWP/FDR consist of 8-foot security fence, 4-foot low profile fencing, and concrete barriers. The installation of the fencing will be required to limit access to the restricted areas designated as a historical mining district. The fencing design is outlined on Sheets 48, and D23 through D26 of the Construction Drawings provided in Appendix A.

The concrete barriers were designed to provide separation between the GMMMA Trail and the Mountain Con Parking Lot. The concrete barrier design is provided on Sheets 48, and D27 to D30 of the Construction Drawings provided in Appendix A.

4.14 Existing Historical Features and Signage

There are several historical features located within the GMMMA that have been identified in the Regional Historic Preservation Plan Anaconda-Butte Heritage Corridor (ADLC-BSB, 1993) or in the *Final Phase II Remedial Investigation/Feasibility Study Report* (BPSOU PRP Group, 2004) that will be preserved as part of the Final GMMMA Phases I and II RAWP/FDRs. The historical features to be preserved are as follows:

1. Corra Air Plenum and Fan Foundation/Mining Landscape;
2. Granite Mountain/Speculator Overlook;
3. Corra Compressor;
4. Belle-Diamond/Lost Mines;
5. Mining Landscapes Compared to Reclaimed Landscapes;
6. Berkeley Pit;
7. Pilot of Butte Overlook;
8. Badger State Mine/Corra Compressor;
9. Top of the World Overlook;
10. Walkerville/Lexington Mine;
11. Copper Collar – Mine Foreman’s Home;
12. Butte National Historic Landmark District, Dublin Gulch, Kelley Mine Yard;
13. Mountain Consolidated Mine Headframe;
14. Mountain Consolidated Mine Hoist House; and
15. Historic Heap Roasting Pile.

The location of the above historical features and the remedy for each of the features can be found on Sheet 52 of the Construction Drawings provided in Appendix A. The sign development and final location of the signs will be a collaborative effort between Butte-Silver Bow Historical Preservation Office and Atlantic Richfield. The signs will be mounted as outlined in Detail 70

on Sheet D48 of the Construction Drawings provided in Appendix A. All sign construction and installation will be conducted as outlined in the Technical Specifications provided in Appendix B.

4.15 Borrow Areas

Implementation of the GMMA Phase II RAWP/FDR will require borrow materials that meet the Butte Hill Revegetation Specifications as outlined in the Technical Specifications in Appendix B. Two borrow sources will be utilized to implement the reclamation for the GMMA Phase II RAWP/FDR. The borrow sources are the Schnell and Helehan Borrow Areas. Soil samples have been collected from each of the borrow areas and were approved by the EPA for use on the BPSOU Source Areas projects implemented in 2007 and the GMMA Phase I RAWP/FDR in 2008. A copy of the data and approvals can be found in Appendix G. Topsoil from the Schnell Borrow areas will be stockpiled at the Ryan Mine Site for use in the project. The Helehan Borrow Area will be further developed and the soils transported to the project site for use in the reclamation. The Helehan Borrow Area design is provided on Sheets 63 through 66 of the Construction Drawings provided in Appendix A.

The Type I riprap and road base materials specified in this GMMA Phase II RAWP/FDR will be obtained from the Westside Soils Borrow Area.

The structural fill required for the implementation of the GMMA Phase II RAWP/FDR will be obtained from the Westside Soils Borrow Area or a suitable borrow area closer to the project site.

The location of the borrow areas and/or stockpile locations and their respective haul routes are identified on Sheet 67 of the Construction Drawing provided in Appendix A.

It will be necessary to borrow fill materials for the completion of the site grading and the construction of the maintenance road. The required fill materials will be obtained from the Mountain Con Borrow Area (Sheets 60 to 62 of the Construction Drawings provided in Appendix A).

5.0 REMEDIAL ACTION WORK PLAN

This section identifies elements to be considered as the GMMA Phase II RA is implemented.

5.1 Construction Drawings

Project Construction Drawings are provided in Appendix A. A Professional Engineer in good standing with the State of Montana will stamp the Construction Drawings when the final version of this RAWP/FDR is issued.

5.2 Construction Technical Specifications

Project Technical Specifications detailing the construction requirements for the GMMA Phase II project are included in Appendix B.

5.3 Design Calculations

The design calculations for the GMMA Phase II RA project are included in the appendices.

5.4 Existing Utilities

Identified existing utilities are located throughout the GMMA and are shown on the Construction Drawings provided in Appendix A. not all existing utilities are necessarily shown. Contractor will be required to locate all utilities prior to the construction activities.

5.5 Environmental Considerations

5.5.1 Air Monitoring

Based on experience and data collected in the BPSOU and surrounding areas, exposure levels to COCs will be significantly below any health-based action levels, as long as fugitive dust is controlled.

5.5.2 Dust Control

Fugitive soil dust emissions will be controlled during RA construction activities. If determined necessary by Atlantic Richfield representatives, operations will cease or will be modified until dust control measures are implemented. Dust control measures will consist of application of water or water with a wetting agent additive.

5.6 Reporting

The contractor will record the following on a daily basis during RA activities:

- Accidents;
- Material delivery and usage;
- Quality Assurance/Quality Control (QA/QC) on required materials; and
- Laboratory analytical results on construction materials.

The QA/QC Oversight Engineer will record the following on a daily basis during RA activities:

- Field observations; and
- Geotechnical and chemical test frequencies and results.

Atlantic Richfield will submit a monthly report to the Agencies of construction activities during RA. The monthly report will include, at a minimum, the following items:

- Summary of daily reports;
- Monthly progress;
- Monthly quantities and production;

- Schedule modifications;
- Schedule projections; and
- Other appropriate information.

At completion of the GMMA Phase II RA activities, a Final Construction Completion Report will be completed and submitted to the Agencies.

6.0 REFERENCES

- ADLC-BSB, 1993. Regional Historic Preservation Plan. Anaconda-Butte Heritage Corridor.
- Atlantic Richfield Company, 2008. Silver Bow Creek/Butte Area NPL Site, Butte Priority Soils Operable Unit, Final Granite Mountain Memorial Area (GMMA) Phase I Remedial Action Work Plan/Final Design Report (RAWP/FDR). April 16, 2008.
- Atlantic Richfield Company, 2005. Letter from the Atlantic Richfield Company to the EPA entitled Repository Design and Access Road, Butte Mine Waste Repository. February 24, 2005.
- BPSOU PRP Group, 2003. Silver Bow Creek/Butte Area NPL Site Butte Priority Soils Operable Unit Granite Mountain Area (GMA) Air Monitoring and Sampling and Analysis Plan (SAP). May 2003.
- BPSOU PRP Group, 2004. Butte Priority Soils Operable Unit, Silver Bow Creek/Butte Area Superfund Site. Final Phase II Remedial Investigation/Feasibility Study Report.
- CIRCULAR DEQ 1. Montana Department of Environmental Quality Circular DEQ 1, Standards for Water Works, February 24, 2006 Edition.
- CIRCULAR DEQ 2. Montana Department of Environmental Quality Circular DEQ 2, Design Standards for Wastewater Facilities, September 10, 1999 Edition.
- CIRCULAR DEQ 4. Montana Department of Environmental Quality Circular DEQ 4, Montana Standards for On-site Subsurface Sewage Treatment Systems, 2000 Edition.
- Dion, T.R., 1993. Land Development for Civil Engineers, John Wiley and Sons, New York, p. 373.
- EPA, 2006. Record of Decision, Butte Priority Soils Operable Unit Silver bow Creek/Butte Area NPL Site. September 2006
- FHWA, 1999. HYDRAIN – Integrated Drainage Design Computer System, Volume VI. HYCHL –Roadside Channels. Office of Technology Applications, Federal Highway Administration, Washington, DC. March 1999.
- ISO. 2006. Guide for Determination of Needed Fire Flow, Edition 05-2006+, ISO, Jersey City, NJ.
- Montana Contractor's Association, 2003. Montana Public Works Standards Specifications, Fifth Edition, March 2003.
- NOAA, 2002. www.noaa.gov/climate.html